TRW

Space and Technology Division

Modular Advanced Signal Channelizer

(MASC)

Program Kickoff Meeting

August 16, 2000

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TRW

David Honey
DARPA

Contract No. MDA972-00-C-0016

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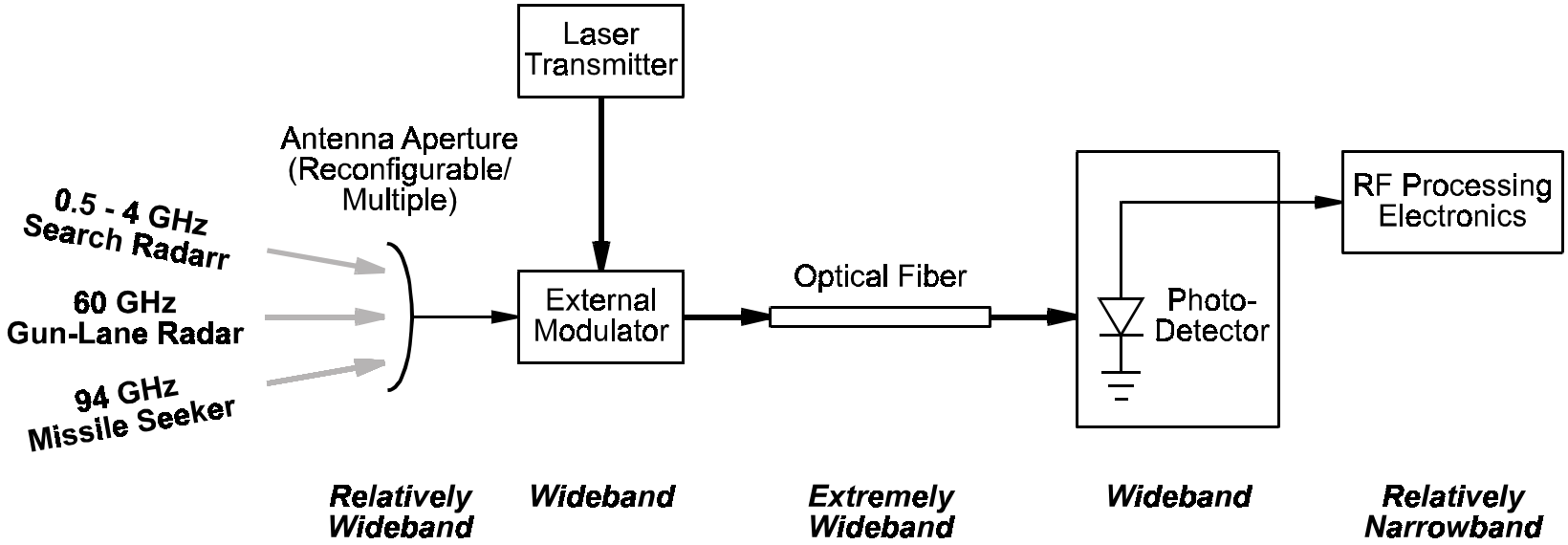
Wideband Requirements of Future Military Systems Motivates the Development of Optically-Based Processing of Analog Signals



- **Developments in reconfigurable antennas, wideband modulators, and photodetectors, combined with the intrinsic bandwidth of fiber make processor electronics the bandwidth bottleneck**

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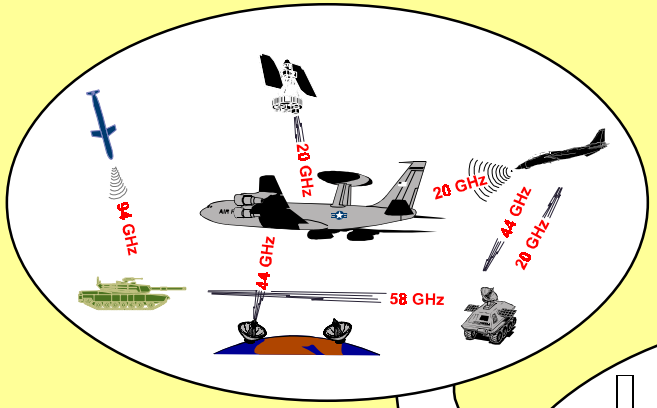
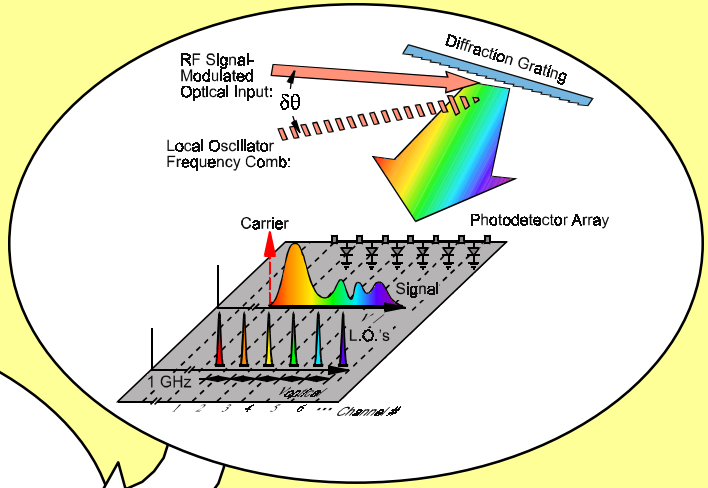
MISSION: EW / ELECTRONIC SUPPORT MEASURES

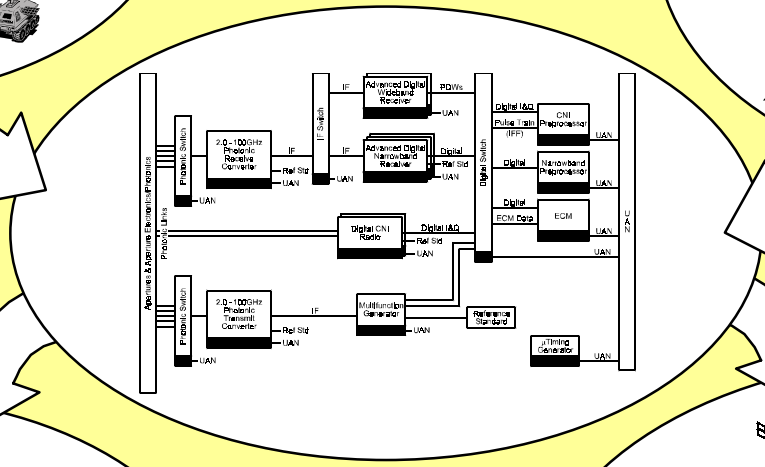
Mission Need



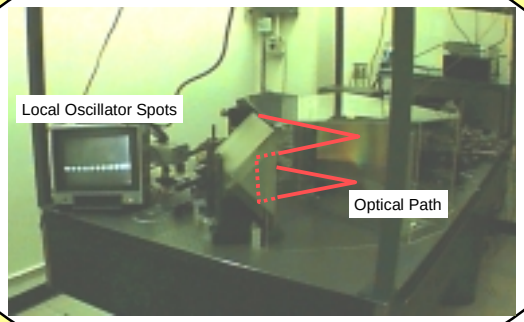
Key Enabling Technology



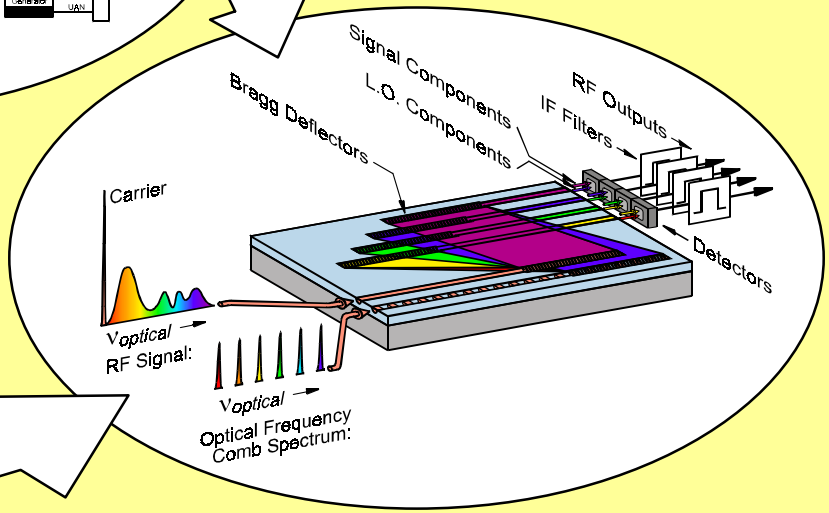
Photonic Subsystem Block Diagram



Proof-of-Concept Demonstration



Modular Concept



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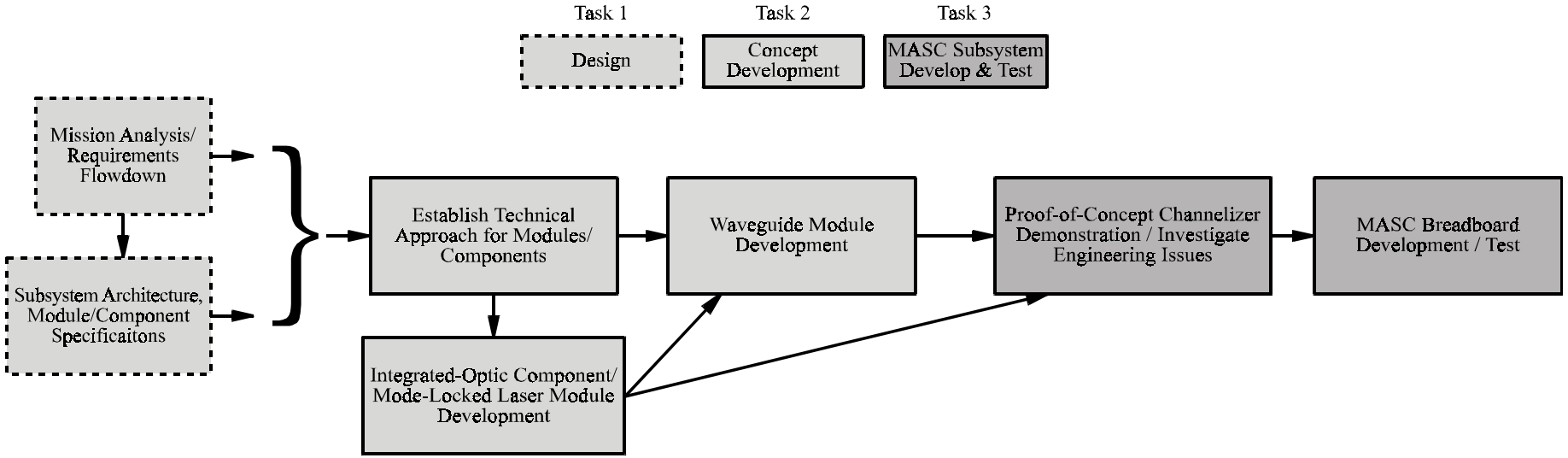
The Modular Advanced Signal Channelizer (MASC) Program will Exploit Emerging Photonics Technologies to Build a Coherent Optical RF Receiver

MASC is a Three Part Program to Develop a Modular, Integrated-Optic-Based RF Lightwave Circuit (RFLIC) for Performing Coherent Channelization of Extremely Wideband RF Signals



MASC program summary

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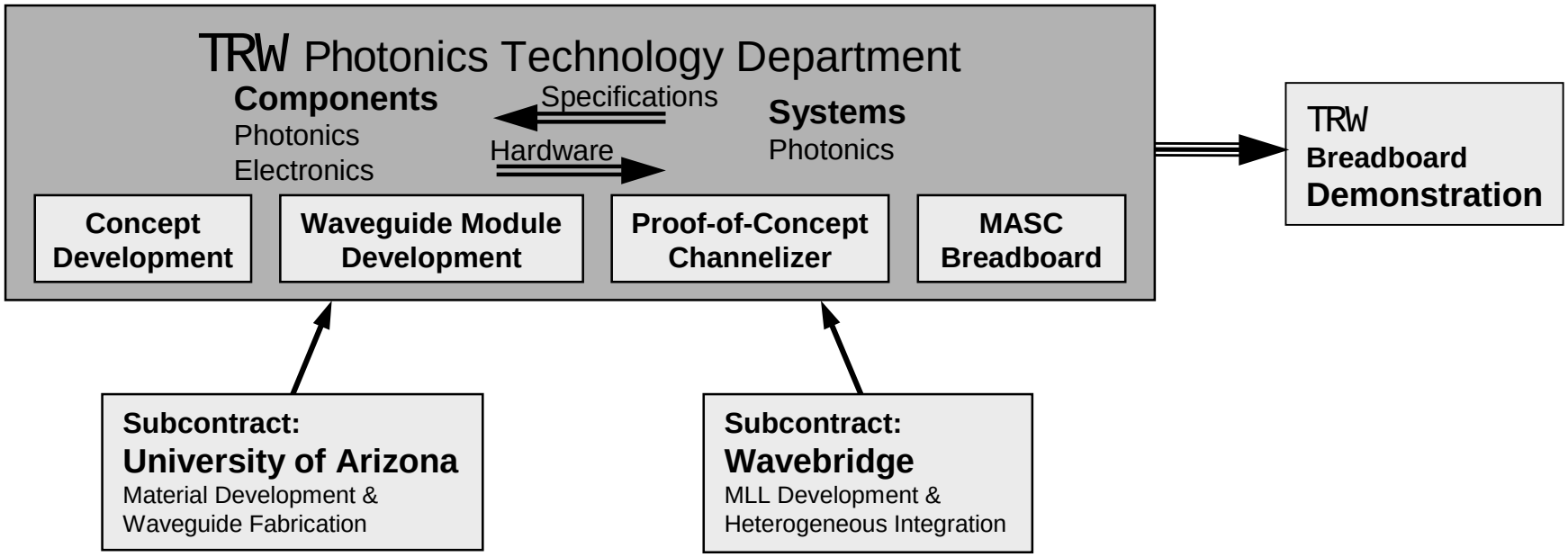
MASC Program Organization



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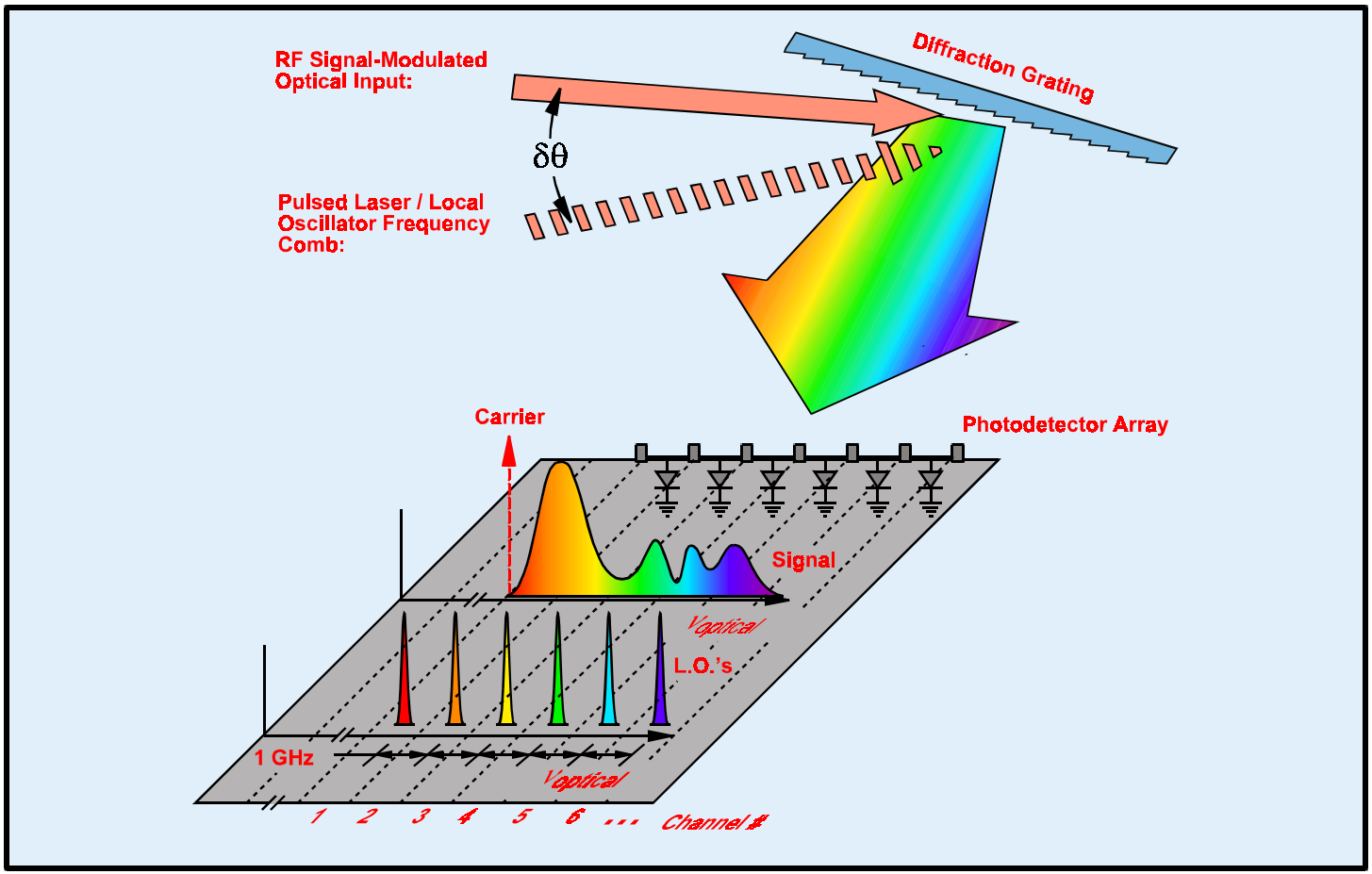
Principle of Operation of a Coherent Optical Channelizer



The signal is impressed on an optical carrier

The local oscillators are injected at offset angle $\delta\theta$ to set the I.F.

The detector signal is the heterodyne beat of λ_{signal} and $\lambda_{L.O.}$

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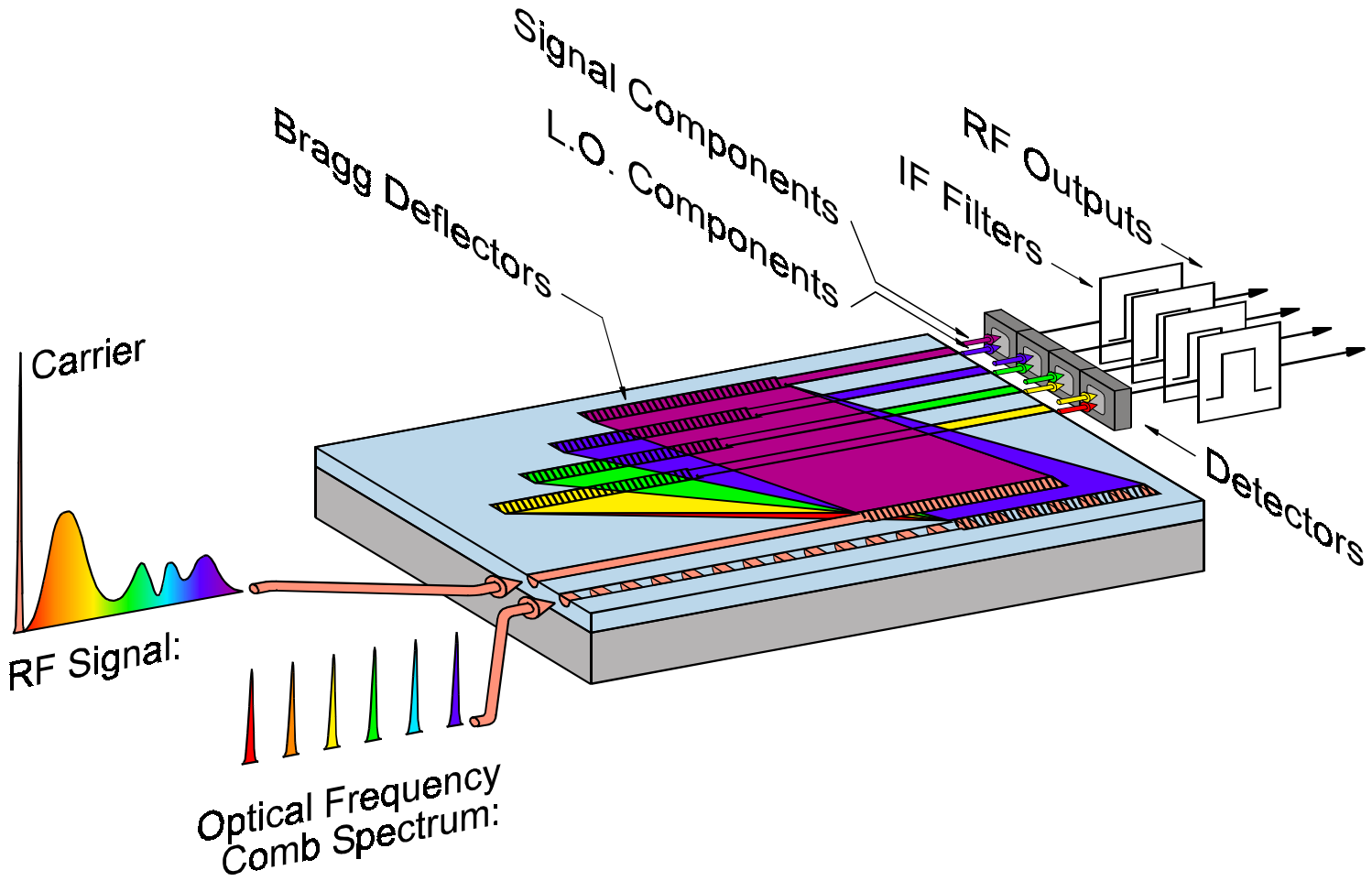
INTEGRATED OPTICAL CHANNELIZER-ON-A-CHIP



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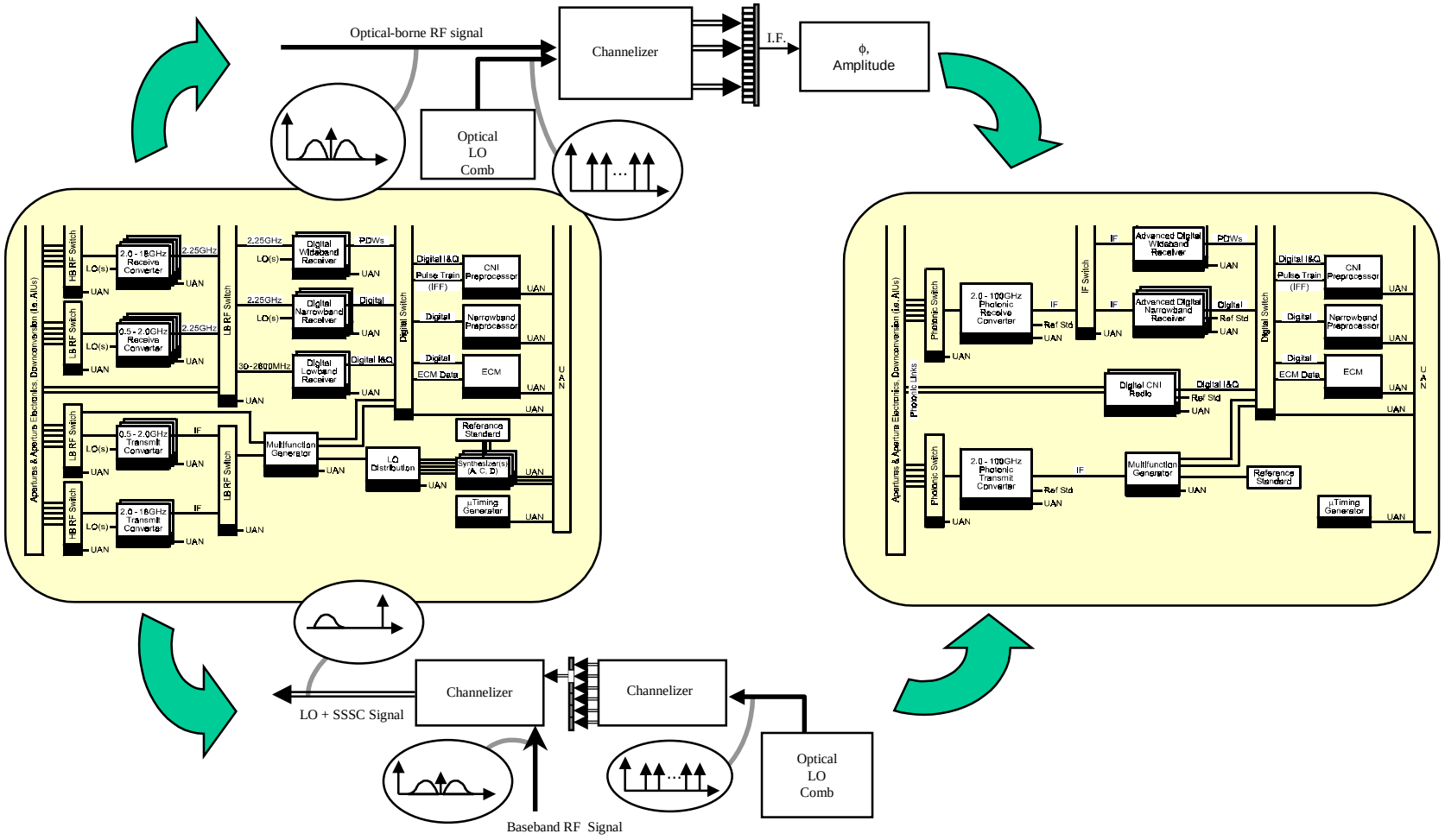
Integrated Sensor System is the Mission Insertion Application for the Photonic Channelizer



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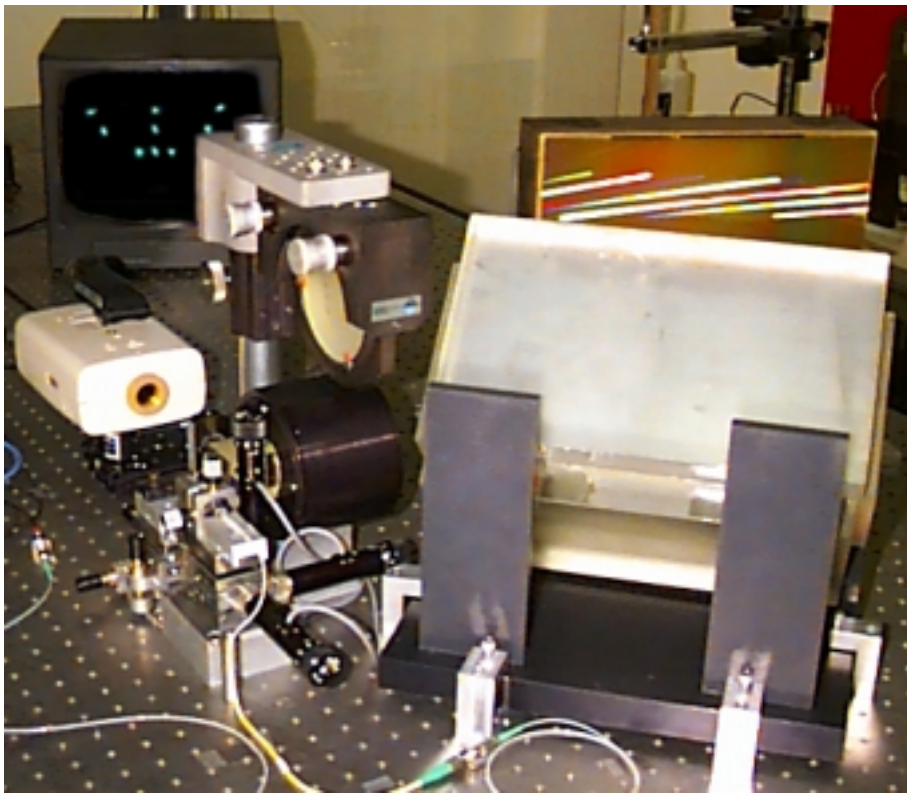
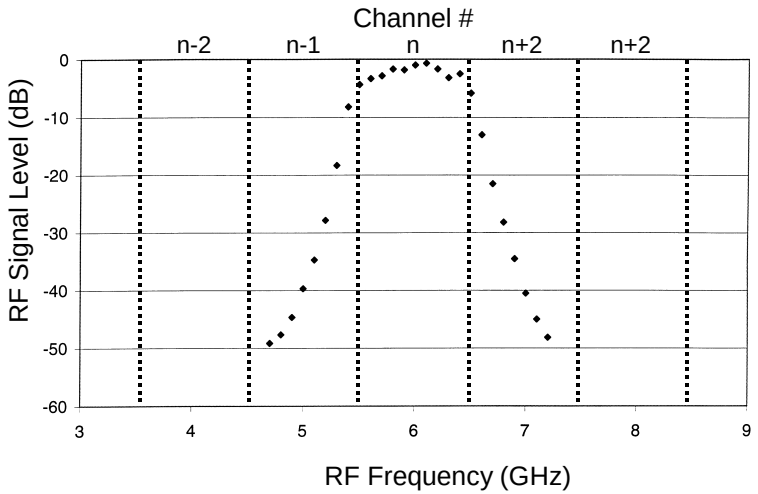
Coherent Optical Channelizer Based on Optical Dispersion is a Proven Technology



TRW/DARPA "CORE" Channelizer :

Monitor Displays Optical Spectrum of DSBSC Signal Beam Modulated with CW Tones at 1GHz, 4GHz, and 5GHZ

Channel Passband Response



Channelizer Dynamic Range

Measured SFDR into 3kHz noise BW	SFDR $BW^{2/3}$ product	Calculated SFDR $BW^{2/3}$ product
82dB	105.2 dB $Hz^{2/3}$	108.0 dB $Hz^{2/3}$

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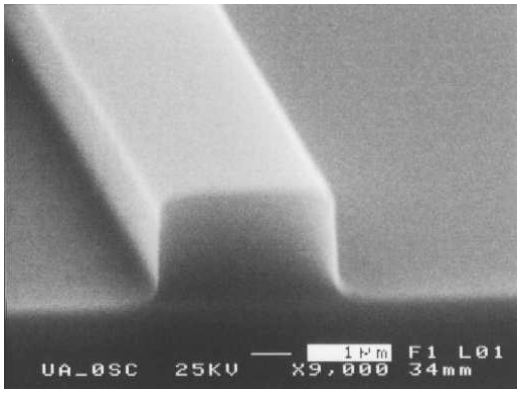
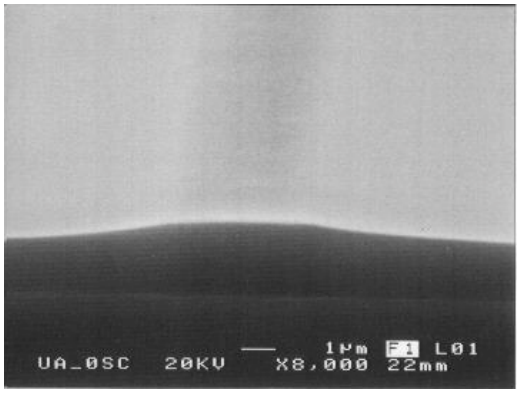
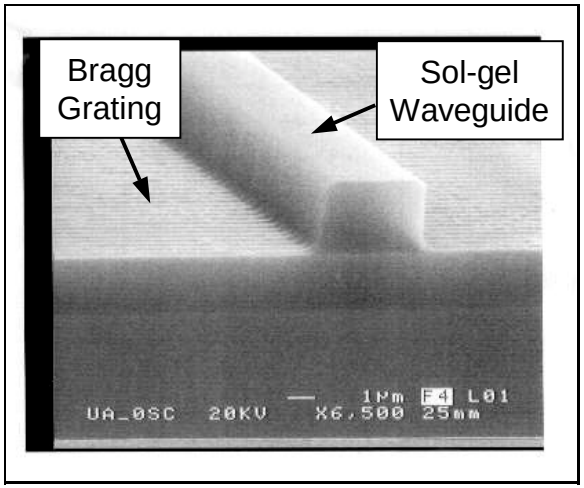
Sol-Gel Glass is a Versatile Material Base for Constructing MASC's Waveguide Structures



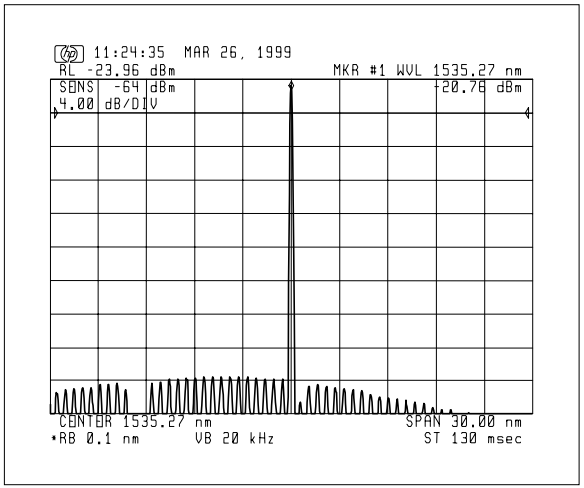
Channel Waveguide



Planarized Waveguide



Sol-gel Bragg Grating for DBR Laser



Lasing Spectrum for DBR Laser

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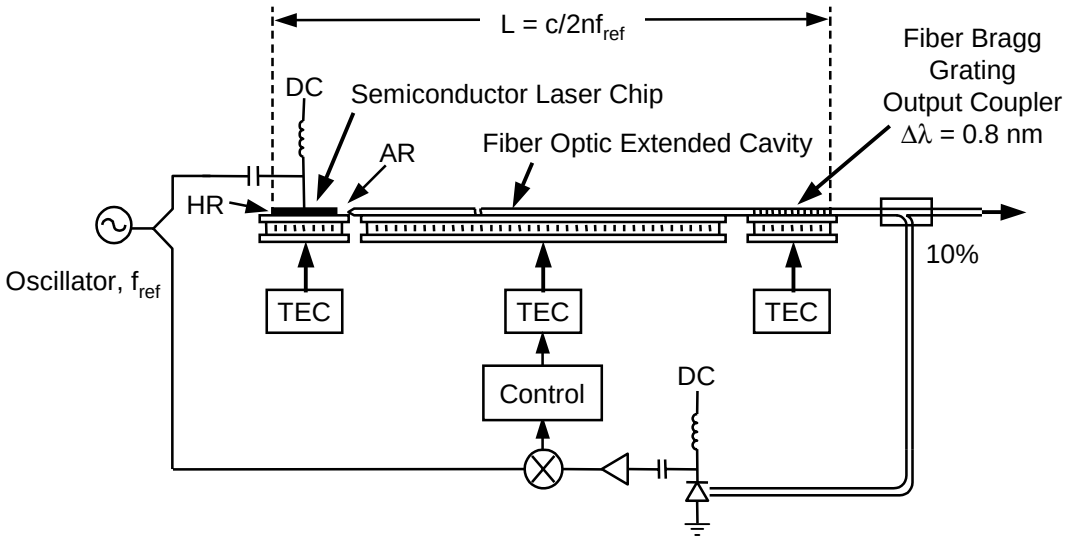
MLL Design Optimizes Frequency Domain Performance



Conceptual Block Diagram of the Mode-Locked Laser

- Envelope of Mode Spectrum Can be Controlled Readily Via Shaping of Grating Reflectivity
- Center Wavelength is Tunable by Temperature Tuning Semiconductor Chip or Fiber Bragg Grating
- Mode Spacing is Monitored and Actively Controlled to Optimize Phase Noise Performance
- Optical Injection Locking will be Used to Establish Phase Coherence with the Signal Carrier